Backprop Equations for RNN

$$\frac{\partial E_t}{\partial U_{ij}} = (\hat{y}_{t_l} - y_{t_l})\, V_{lm} \sum_{r=0}^{t} \frac{\partial s_{t_m}}{\partial s_{r_n}} \frac{\partial s_{r_n}}{\partial U_{ij}}.$$

$$\frac{\partial E_t}{\partial W_{ij}} = (\hat{y}_{t_l} - y_{t_l})\, V_{lm} \sum_{r=0}^{t} \frac{\partial s_{t_m}}{\partial s_{r_n}} \frac{\partial s_{r_n}}{\partial W_{ij}}.$$

$$\frac{\partial E_t}{\partial V} = (\hat{y}_t - y_t) \otimes s_t,$$